Implementation Assessment
for
New Galley Equipment

Prepared for:
The Under Secretary of the Navy

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14 January 2000

Table of Contents

6.3 Total Costs Savings over 5-Year Period

1. Executive Summary

1.1 Description: Aggressive installation of this equipment by the Program Executive Offices and Type Commanders should be encouraged in order to maximize savings and improve the Quality of Life for Sailors. This Implementation Assessment provides a review of potential savings available through aggressive installation of advanced food service equipment. This assessment compiles data from various sources to demonstrate the potential savings associated with use of advanced food service equipment and assumes an installation schedule based upon planned ship availabilities.

Program Executive Offices (PEOs) are responsible for funding the installation of this equipment. Type Commanders prioritize equipment installation based upon service-life remaining on existing equipment and available funds. There is no formal plan in place to convert from traditional food service equipment to advanced food service equipment for the entire Fleet. For purposes of this review, it was assumed all traditional equipment would be converted to advanced food service equipment during upcoming availabilities. Though a complete conversion of equipment is neither actually scheduled or funded, making that assumption allows us to demonstrate the return on investment that is possible if equipment were installed on all ships undergoing an availability over the next five years. The return on investment for such a proposal is provided below.

1.2 Summary Table 5-Year ROI (Cost/Savings/ROI Per Annum):

	FY 00	FY 01	FY 02	FY 03	FY 04	Total ($M)
Total Annual Cost *[1]	15.65	23.86	24.24	8.23	8.40	80.38
Total Annual Implementation & Acquisition Savings[2]	5.55	14.10	22.93	26.26	29.79	98.63
Total Annual Operations & Sustainment Savings[3]	2.40	6.09	9.74	11.35	12.88	42.46
Total Annual Food Efficiency Savings	0.12	0.30	0.49	0.56	0.64	2.11
Total Annual Savings	8.07	20.49	33.16	38.17	43.31	143.20
Return on Investment	**-7.58**	**-3.37**	**8.92**	**29.94**	**34.91**	**62.82**

* Costs and savings are based upon 100 percent Fleet implementation over a five-year period. For purposes of this assessment, costs/savings are projected for installation of Combination Ovens, Clamshell Griddles and Skittles onboard CV/CVNs (12), "L" Decks (40), "A" Decks (14), and CG/DDG/FFGs (116). The percent of the Fleet that will be implemented is as follows: FY 00 = 20%, FY 01 = 30%, FY 02 =30%, FY 03 = 10%, FY 04 = 10%. This hypothetical implementation schedule is based upon planned ship availabilities.

Return on Investment in manpower savings should be realized only after this initiative is proven on deployment and the corresponding workload reduction is validated by NAVMAC and tied to specific billets.

1.3 Benefits: A complete change out of traditional food service equipment during availabilities could provide workload savings, reduced Total Ownership Cost and improve the Quality of Life for the Mess Management Specialists and Food Service Attendants by reducing workload and providing the newest in cooking technologies. The Sailor also benefits by improved food quality. This study reinforces what was already surmised, that installation of advanced food service equipment is a smart business decision.

Laboratory studies and field tests have demonstrated labor and operational savings derived from use of advanced food service equipment that include: 1) reduced cleaning times, 2) reduced maintenance workload, 3) reduced cooking times 4) higher cooking yields, and 5) improved quality product to the Sailor. In most cases, the multi-functional nature of the advanced equipment allows replacement of multiple pieces of traditional equipment with a lesser number of pieces of advanced food service equipment. For example, a combination oven can function as a traditional convection oven, two high-pressure steamers, a dough proofer, holding cabinet, or oven fryer.

2. Background

2.1 Objectives/Scope – Detailed Description: Originally, advanced food service equipment was identified for proof of concept and demonstration testing by Naval Sea Systems Command's Affordability Through Commonality (ATC) Program (PMS512). As an RDT&E program now under PEO DD-21, PMS512 identifies technologies and concepts that have cross-Navy applicability and reduce costs. The combination convection oven/steamer, skittle, clamshell griddle, powered condiment dispenser and deep fat fryers with integral filtering are examples of this type of equipment. Most pieces of advanced food service equipment have been tested on board surface ships only; however, development is underway of a combination oven that will fit through a submarine hatch for installation. Although some of these pieces of equipment represent a higher acquisition cost, life-cycle savings (based on labor, operations and maintenance costs) result when compared to traditional equipment.

The ATC evaluation team was comprised of members from Naval Supply Systems Command, Naval Sea Systems Command, US Army Soldier & Biological Chemical Command (Natick Labs), Naval Surface Warfare Center, Philadelphia Division and M. Rosenblatt & Son, Inc. The team was tasked to explore ways to reduce the life cycle costs of shipboard food service operations. Commercial market analysis of improved food service technologies included discussions with manufacturers, site visits to user facilities and an equipment acquisition, testing and evaluation program. Each piece of equipment was placed onboard a ship and operated under "at sea" conditions. Any equipment modifications for shipboard use were made before installation on a test platform. Informal surveys were conducted on the ease of operation and cleaning, cooking yields and maintenance workload. Several pieces of equipment have proven successful and are currently deployed in Navy ships.

Combination Oven: The "combination" oven is a multi-functional piece of equipment that can bake with dry heat, cook with steam, or bake with dry heat and steam. The combination oven can function as two high pressure steamers with exhaust hood and one standard double convection oven. Additionally, new cooking technology allows most foods that were previously cooked in the deep fat fryer to be oven-baked, eliminating use of the deep fat fryer.[4] This not only results in significant cost savings and safety but also improves nutrition afloat through elimination of deep fat frying. One commercial combination oven was installed onboard USS KEARSARGE (LHD-3) in February 1997 and Natick Laboratory's anticipated results pertaining to savings in cooking/cleaning times and higher cooking yields using the combination oven were confirmed.[5] Additionally, very little maintenance was required on this unit. Only one failure occurred in 19 months of heavy usage. The results of these initial tests were used by industry to develop the design for a hatchable shipboard combination oven that would fit through a standard surface ship hatch.[6] Improved designs of the hatchable combination oven have been placed aboard USS RENTZ (FFG-46), USS JOHN C. STENNIS (CVN-74), USS CONSTELLATION (CV-64), USS SUPPLY (AOE-6), USS RAINIER (AOE-7), USS ARCTIC (AOE-8), USS JOHN F. KENNEDY (CV-67), USS VICKSBURG (CG-69), and USS DECATUR (DDG-73).

Combination Oven/Steamer Savings

- Increased product yield – 30% more using standard roast beef test[7]
- Decreased cooking time – 30% less using standard roast beef test[8]
- Decreased cleaning time – 50-60% less than standard cleaning time [9] (Convection oven: 30 minutes/day cleaning for spills plus 2 hours/month deep cleaning vs. Combination Oven: 15 minutes/day for spills plus 1 hour/month for deep cleaning)
- Capital investment savings – can replace two high pressure steamers with exhaust hood and one standard double convection oven[10]

Skittle: The skittle is a multi-functional piece of equipment that can be used to steam, grill or hold hot food. The skittle can function as a high-pressure steamer, one griddle or one hot holding cabinet. One commercial skittle was installed onboard USS CONSTELLATION (CV-64) in July 1998 and Natick Laboratory's anticipated results pertaining to its versatility, ease of cleaning and efficient cooking were confirmed.[11] Subsequent to initial testing, the skittle has been installed onboard USS JOHN C. STENNIS (CVN-74) and USS RAINIER (AOE-7).

Skittle Savings

- Capital investment savings – can replace pressure steamers, griddles and hot holding cabinets, and reduce exhaust hood requirements.[12]

Clamshell Griddle: The clamshell griddle was selected for testing due to its demonstrated speed of cooking. This piece of equipment cooks from both top and bottom simultaneously. One six-foot long clamshell grill replaces two six footlong standard griddles. One commercial clamshell griddle was

installed onboard USS DWIGHT D. EISENHOWER (CVN-69) in May 1998 and Natick Laboratory's anticipated results pertaining to reduced cooking times were confirmed.[13] Subsequent to initial testing, the clamshell griddle has been installed on USS BRIDGE (AOE-10), USS RAINIER (AOE-7) and USS JOHN C. STENNIS (CVN-74).

Clamshell Griddle Savings

- Decreased cooking time – 50-70% less using a standard meat cooking test[14] (4 oz. Hamburger cooking to internal temp of 160 degrees)
- Decreased workload – reduces workload by 50%
- Capital investment savings – reduces griddle/exhaust hoods by 50%[15]

Testing Underway: Other pieces of equipment undergoing testing include the powered condiment dispenser and deep fat fryers with integral filtering system. Shipboard installation and testing is still required to validate anticipated savings and "sea-."

2.2 Implementation Components: Traditional food service equipment can be replaced incrementally or all at once, depending upon funding and the ship's availability schedule. In the past, the limited installation of advanced food service equipment was managed by NAVSEA as part of the ATC Program. The current implementation strategy used by some Type Commanders calls for replacement of traditional food service equipment as it nears the end of its service life. Currently there is no activity leading or funding the efforts to ensure design changes are developed for equipment upgrades during platform availabilities; however, OPNAV-N41 is building a team with Fleet, NAVSEA and NAVSUP participation to develop an implementation strategy. Galley design changes may be required, by ship type, for installation of advanced food service equipment. Engineering Change Proposal 0039 identifies required design changes for NIMITZ Class CVNs. A SHIPALT onboard USS TARAWA (LHA-1) was developed in order to install advanced food service equipment as part of the Single Ship Prototype that is testing multiple food service initiatives on one platform. Additional preliminary design studies for DDGs and LPD-17 have been performed by various shipyards. New construction ships are being encouraged to incorporate advanced food service equipment into the baseline design.

3. Benefits

3.1 Summary List: Potential benefits will include:

- Increased cooking yields and consistent quality products
- Reduced cooking and cleaning times
- Multi-functional equipment
- Reduced maintenance

3.2 Individual Benefit Description

3.2.1 Increased Cooking Yields and Consistent Quality Products: Advanced food service equipment provides the latest commercial technology, enabling a higher product yield and more consistent quality products. There is less food shrinkage through use of this equipment. Similarly, the new technology equipment provides more uniform cooking temperatures that result in a consistent quality product.

3.2.2 Reduced Cooking and Cleaning Times: Advanced food service equipment is engineered to minimize cooking and cleaning times through improved design and state-of-the-art cooking surfaces. Equipment such as the clamshell griddle cooks simultaneously from the top and bottom, reducing cooking time. The combination oven is cleaned with steam and requires less physical labor to clean than a traditional convection oven.

3.2.3 Multi-Functional Equipment: Most traditional galley equipment has only one function. New technology food service equipment is designed to be multi-functional and can perform the function of several pieces of traditional equipment. Equipment such as the Skittle can function as a pressure steamer, griddle or a hot holding cabinet. This can reduce the number of individual pieces of equipment and associated ventilation/plumbing/electrical requirements.

3.2.4 Reduced Maintenance: Advanced food service equipment can replace multiple pieces of traditional food service equipment. Reduced amounts of equipment equate to reduced maintenance hours, fewer repair parts, less electricity/steam for operation and fewer fire suppression systems. The combination convection oven steamer has self-diagnostic capability and convenient access to parts that may need to be repaired or replaced. The skittle has easily accessible, clustered electrical components. Additionally, the reliability of the new technology equipment is higher than traditional food service equipment.

4. Associated Cost Savings

The savings associated with increased use of advanced food service equipment consist of tangible and intangible savings. Tangible savings can be quantified accurately. Intangible savings are considered as those either impossible to quantify or beyond the scope of this review.

4.1 Tangible Savings

4.1.1 Implementation and Acquisition Savings ($29.8M annual savings):[16] Savings cited are for FY 04, when advanced food service equipment is installed on all ships. These savings include all factors affecting implementation, including: reduced cleaning/maintenance workload, equipment redesign efficiencies, operator reductions and reduced total acquisition costs. Technological enhancements in food service equipment reduce cleaning, cooking and maintenance times. Advanced designs, coupled with the latest cooking surfaces, significantly reduce the amount of time spent cleaning

equipment. Additionally, in some cases, fewer operators are needed to cook the same amount of food. Although initial acquisition cost for advanced food service equipment is high, savings can be realized by not procuring the original piece of equipment being replaced and other pieces of equipment that are no long required with installation of multi-functional advanced food service equipment. Although cooking time utilizing this equipment is significantly less than traditional equipment, reduced cooking time does not equate to reduced manning requirements. Savings projected above do not include any savings due to reduced cooking times. USS JOHN C. STENNIS (CVN-74) is the first ship to have a complete suite of advanced food service equipment installed in one galley. A complete workload analysis onboard USS JOHN C. STENNIS (CVN-74) is required in order to accurately project potential workload savings that result when an entire galley has been converted from traditional equipment to advanced food service equipment.

4.1.2 Operations and Sustainment Savings ($12.9M annual savings):[17] Savings cited are for FY 04, when advanced food service equipment is installed on all ships. A study of Operations and Sustainment savings was conducted by Advanced Engineering and Research Associates, Inc. (AERA) based upon a tasking by the ATC Program Office. The study predicts significant savings over a ship's life cycle for conversion to advanced food service equipment and co-located galleys. This savings includes reduced fuel consumption, reduced maintenance for galley equipment, and reduced overhaul costs. Total Operations and Sustainment savings were identified for both advanced food service equipment and a co-location of galley spaces to improve efficiency. In that this assessment focuses only on advanced food service equipment replacement, the total annual savings calculated in the AERA Study ($78.6M) have been reduced proportionately (85%) in order to exclude savings associated with galley co-location. Only $11.8M of the predicted AERA study savings have been applied to the ROI calculations.

4.1.3 Increased Production Capacity and Product Yield ($.64M annual savings):[18] Savings cited are for FY 04, when advanced food service equipment is installed on all ships. Use of the combination oven increases product yield in standard tests for roast beef and other meat products. Increased product yield is experienced due to the use of steam in combination with convection dry heat (combination oven) vice dry heat only (convection oven). The standard roast beef test is the industry accepted metric for measuring oven yields. The test consists of weighing approximately 40 lbs of roast beef, cooking the meat, re-weighing the end product and converting the cooked roast into servings. A traditional convection oven would shrink 1.5 million pounds of roast beef (the amount consumed in Navy during FY 99) to approximately 3.75 million servings. Use of the combination oven would result in 3.975 million servings for the same 1.5 million pounds of roast beef. An increased yield of 225,000 servings, at $.80 per serving, would result in annual savings of approximately $180K for roast beef only. A similar level of savings can be assumed for pork, chicken, veal, meat loaf, etc. Conservatively, the savings associated with cooking roast beef in the combination oven could be tripled to account for savings in other meat products normally cooked in an oven. Based on that assumption, annual savings would approximate $585K. These savings are associated with the combination oven only. Savings associated with other equipment have not been quantified.

4.2 Intangible Savings

4.2.1 Improved Safety: Each piece of equipment has been reviewed and approved to ensure all shipboard safety requirements are met. Additionally, several pieces of equipment significantly improve safety. The combination oven can replace deep fat frying for most items that are traditionally deep fried. This reduces the fire hazard associated with deep fat fryers and potential burns from hot grease while cooking. Also, the burn hazard from pressurized steamers is eliminated with the use of the skittle and combination oven. The ability of the skittle to serve as a hot cabinet reduces the amount of hot food that must be transported from the cooking surface to a holding cabinet. The deep fat fryer with integral filtering extends the life of cooking grease. This reduces the amount of times hot grease must be transported and disposed of while underway.

4.2.2 Improved Quality of Life: Mess Management Specialist pride and professionalism is improved by providing the latest technology available for their profession. Reduced workload associated with advanced food service equipment improves Quality of Life for Mess Management Specialists, Food Service Attendants and Maintenance Technicians. Additionally, overall Quality of Life for Sailors is improved through production of consistently high quality food products.

5. Cost to Implement

5.1 Proof of Concept Costs (Prototypes): There are no proof of concept costs. Prototypes have already been funded and conducted.

5.2 Deployed Systems Costs (Fleet-Wide Implementation): This estimate is based upon the design requirements and ship availability schedules. The estimated cost for deployment of advanced food service equipment is as follows:

FY 00:	$ 15.65M
FY 01:	$ 23.86M
FY 02:	$ 24.24M
FY 03:	$ 8.23M
FY 04:	$ 8.40M

The deployed systems costs are provided to demonstrate what it would cost to aggressively deploy advanced food service equipment in the Fleet. This is not the schedule utilized by PEOs or Type Commanders, who are deploying equipment on an “as required” basis. Rather this schedule is meant to demonstrate the costs associated with accelerating installation. Costs include equipment acquisition and installation, as well as anticipated design changes.

6. Conclusions

6.1 Short Summary of Benefits: Based on this review, the Navy will obtain a significant amount of savings through increased use of advanced food service equipment. Reduced cleaning times, maintenance times, improved Quality of Life for the Sailor, reduced cooking times and increased product yield constitute the primary benefits.

6.2 Assumed Cumulative Implementation Plan:

FY 00 and beyond	As PEO/Type Commander funding permits

6.3 Total Costs Savings over 5-Year Period: An estimated total savings of $62.82M is forecast for a five-year period.

An estimated total savings of $62.82M is forecast for a five-year period.[19]

Attachment 1: ATC Annual Equipment, Design, Install Cost summary
Attachment 2: Overhaul Schedule
Attachment 3: Acquisition Savings
Attachment 4: ATC Annual Implementation and Acquisition Savings Summary Sheet by Equipment
Attachment 5: Natick Labs Cost Analysis Report: Combi-Ovens
Attachment 6: Natick Labs Cost Analysis Report: Skittle
Attachment 7: Natick Labs Cost Analysis Report: Clamshell Griddle
Attachment 8: Natick Labs "Eliminating Deep Fat Fryers-Oven Frying"
Attachment 9: USS Stennis NFMT Data Sheet
Attachment 10: Total Annual Food Efficiency Schedule

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[1] Chart is based on industry information. Direct questions on the review to NAVSUP 51. See Attachments 1, 2 and 3

[2] See Attachments 4 thru 7

[3] "Co-located Galley for the Affordability Through Commonality Program" by AERA, Inc. Aug 1997 Direct questions on AERA Study to NAVSUP 51. AERA Study by NAVSEA predicts Operations and Maintenance Savings for 1) reduced full consumption, 2) reduced PM for the new galley equipment, 3) reduced depot maintenance. See pages 7 – 10 that address the DDG-51 Baseline vs. Co-located Galley Costs. Savings equal $17.3M/ hull over a 40 year life cycle. = $432K/yr/ hull x182 hulls. = $78.6M total savings /yr. This savings included the equipment evaluated in this study plus a co-located galley layout. Since this study pertains only to new equipment (not co-located galley), only 15% of savings would be used for ROI purposes. ($78.6M x 15% = $11.79M).

[4] See Attachment 8, Natick Lab studies

[5] See Attachment 4, Natick Lab studies

[6] ATC study on USS KEARSARGE (LHD-3) results of Aug 1998

[7] See Attachment 5, Natick Lab studies

[8] See Attachment 4, Natick Lab studies and Attachment 9, USS Stennis (CVN-74) NFMT data

[9] See Attachment 4, Natick Lab studies

[10] See Attachment 4, Natick Lab studies

[11] See Attachment 5, Natick Lab studies and Attachment 9, USS Stennis (CVN-74) NFMT data

[12] Based on Attachment 5, Natick Lab studies and NAVSEA 05L5 input

[13] See Attachment 6, Natick Lab studies and Attachment 9, USS Stennis (CVN-74) NFMT data

[14] See Attachment 6, Natick Lab studies and Attachment 9, USS Stennis (CVN-74) NFMT data. This food testing estimate is also addressed by The Art and Science of Culinary Preparation, by J. Chesser CEC, CCE, Educational Institute of the American Culinary Federation, page 22.

[15] See Attachment 6, Natick Lab studies

[16] See Attachment 4

[17] See ROI Table note.** AERA Study by NAVSEA predicts Operations and Maintenance Savings for 1) reduced full consumption, 2) reduced PM for the new galley equipment, and 3) reduced depot maintenance. See pages 7 – 10 that address the DDG-51 Baseline vs. Co-located Galley Costs. Savings equal $17.3M/hull over a 40-year life cycle = $432K/yr/hull x182 hulls =$78.6M total savings/yr. This savings included the equipment evaluated in this study plus a co-located galley layout. Since this study pertains only to new equipment (not co-located galley), only 15% of savings would be used for ROI purposes ($78.6M x 15% = $11.79M).

[18] Fixed Price List data and Attachment 10, Total Annual Food Efficiency Savings

[19] See ROI Table Cell F13